

ELECTRONIC FUNDAMENTALS

EXPERIMENT LESSON 1

HOW TO SOLDER

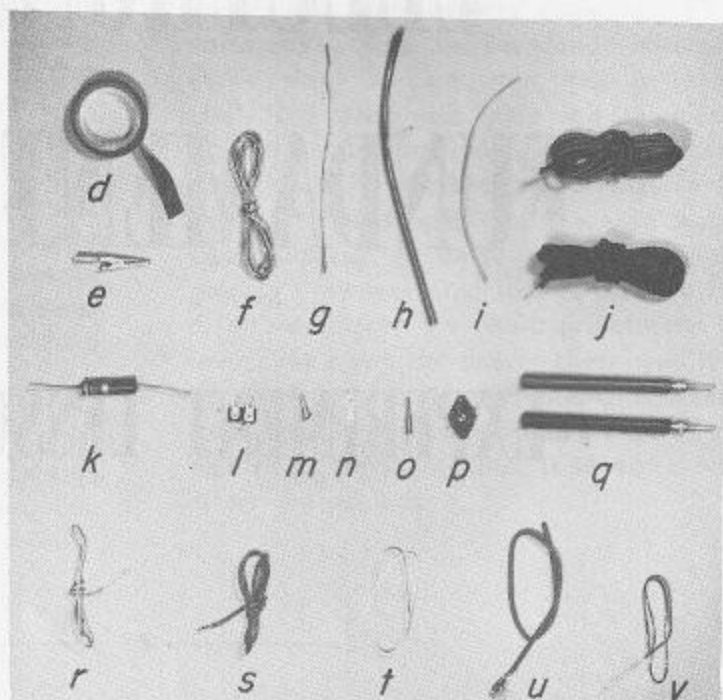
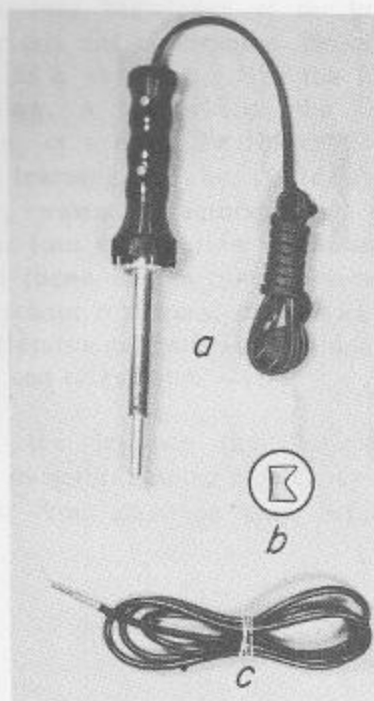


RCA INSTITUTES, INC.

A SERVICE OF RADIO CORPORATION OF AMERICA

HOME STUDY SCHOOL

350 West 4th Street, New York 14, N. Y.



Note: If two or more parts look alike, only one is shown

All the parts in Kit 1 are listed below. Check the parts you receive against this list. Make sure you have the correct quantity of every item. If a part is either missing or defective upon arrival, request a replacement from Department R, Home Study School, RCA Institutes, Inc., 350 West 4th Street, New York 14, N.Y. Your request must include your name and student number, the complete name and description of the part copied from the Item column below, the Quantity missing or defective, and the reason you are asking for a new part.

KIT 1

BILL OF MATERIALS

Quantity	Item	Quantity	Item	Quantity	Item	
1.	a. Soldering iron	6	k. Resistor, 5%	13	n. Ground lug	
1	b. Stand for soldering iron	To read resistor values, hold resistor with bands to left, as shown in Figure. Read bands from left to right. (Gold band = 5% tolerance, Silver band = 10% tolerance, No band = 20% tolerance)			4	o. Phone tip
3'	c. Coaxial cable	(1) Brown, Black, Brown = 100 ohms		1	p. 7-pin miniature tube socket	
1	d. Roll of plastic electrician's tape	(1) Red, Red, Brown = 220 ohms		2	q. Test prod (1 red, 1 black)	
6	e. Alligator clip	(1) Orange, Orange, Brown = 330 ohms		1'	t. Shielded phono lead	
10'	f. Rosin-core solder	(1) Brown, Black, Red = 1,000 ohms		1'	s. Stranded pushback wire	
6"	g. Solid solder	(1) Brown, Black, Orange = 10,000 ohms		1'	t. Solid tinned pushback wire	
6"	h. Large spaghetti	(1) Brown, Black, Yellow = 100,000 ohms		1'	u. Rubber-covered stranded fixture wire (untinned)	
1'	i. Small spaghetti	2	k. Resistor, 20%	1'	v. Enameled solid wire (untinned)	
2	j. Test-lead wires (4' each) 1 red, 1 black	(1) Brown, Black, Orange = 10,000 ohms				
		(1) Brown, Black, Yellow = 100,000 ohms				
		2	l. Two-lug terminal strip	1'		
		18	m. Wood screws (#6)			
		2	m. Wood screws (#4)			

If you get a part slightly different from a part described in this list, the substitute part will not interfere electrically or mechanically with your experiments or equipment.

Experiment Lesson 1

OBJECT

The object of the experiments in this lesson is to learn:

1. How to solder with an electric soldering iron.
2. How to tell when solder has properly set (hardened) by looking at it.
3. How to prepare materials for soldering.
4. How to join wires together.
5. How to make soldered connections.
6. How to unsolder connections.

INFORMATION

Of all the practical things a serviceman must know how to do, nothing is more important than knowing how to solder. Look at any radio or television chassis and see all the soldered connections. The people who make these receivers know that soldered connections last longer and cause less

trouble than connections made in any other way. To maintain and repair such equipment, you must know how to solder and unsolder.

Soldering is the uniting of metals with solder. Solder is a fusible alloy. In plain words, solder is a combination of metals that melts at a lower temperature than the metals it will hold together. There are two main classes of solder: hard solder and soft solder. Soft solder is usually used in radio and other electronic equipment.

Soft solder is usually a mixture of tin and lead. The most popular solder among servicemen is a combination of 50 percent tin and 50 percent lead, which is usually written 50/50. The first figure always indicates the percentage of tin, and the second figure the percentage of lead. Chart A shows that 50/50 solder starts to melt at 361 degrees F and is liquid at 414 degrees F. Between these two temperatures, it is said to be in a *plastic* state. Looking at Chart A again, we find that some combinations of tin and lead are plastic for a greater change in temperature, while others are plastic for a smaller change in temperature. Those that have a

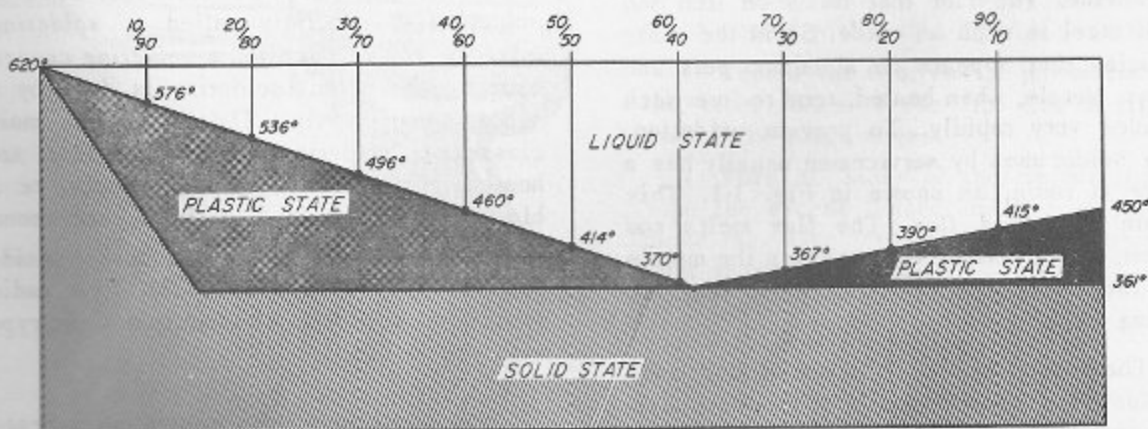


CHART A - TIN-LEAD RATIO CHART

greater change in temperature during the plastic period take longer to harden than those with a smaller change. For example, 20/80 and 30/70 solders harden very slowly; 40/60, 50/50, 70/30, and 80/20 solders harden more quickly, and 63/37 solder hardens almost instantly. Notice that some combinations of tin and lead melt at a lower temperature than either of these metals melts at by itself.

In choosing a solder, remember:

1. Slow-cooling solders tend to make smoother joints.
2. When work is held upright, the solder tends to flow down, away from the joint. Therefore, quick-hardening solders should be used when the parts to be joined cannot be held flat.
3. Solders containing from 55 percent to 70 percent tin are stronger than those containing more lead.
4. The best solder you can buy is usually the cheapest in the long run. There is less waste.

Most servicemen use 50/50 solder because it is the best single combination for all the requirements listed above.

Flux. The surface of a metal tends to combine with the oxygen of the air to form an *oxide*. The rust that forms on iron and steel is such an oxide. So is the white coating that appears on aluminum pots and pans. Metals, when heated, tend to form such oxides very rapidly. To prevent oxidation, the solder used by servicemen usually has a core of rosin, as shown in Fig. 1-1. This rosin is called *flux*. The flux melts and forms a thin coating that protects the metals of the joint from oxidizing while they are being heated.

There are two main classes of flux: *corrosive* and *noncorrosive*. The corrosive fluxes most often used are hydrochloric acid (sometimes called muriatic acid), zinc chloride, and sal ammoniac. These fluxes

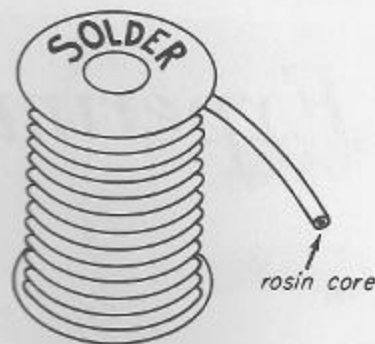


Fig. 1-1

are not used in radio wiring because it is practically impossible to clean away all the acid after the joint is made. If acid remains, it eats away at the joint and, sooner or later, causes trouble. The most popular noncorrosive fluxes are rosin and tallow. In addition, paste fluxes, which are said to be noncorrosive, are made. However, unless all paste flux is carefully removed after the joint cools, dust collects around the joint and absorbs moisture. This may cause a chemical action that may produce an *open circuit*. If not, the electrical joint may be come so poor that it causes the receiver to be noisy. For soldering copper and brass in radio work, rosin is by far the best flux that we know of.

Solder comes in many forms: in solid 1-1/2-pound bars, as solid solder wire, as flux-core solder wire, in pellets, and in special shapes made to order.

Soldering Irons. While the tool used in soldering is generally called a *soldering iron*, it could be called a *soldering copper*, because the actual soldering is done by a heated copper tip. There are two main classes of soldering irons: those that are heated by a gas flame, live coals, or a blowtorch (shown in Fig. 1-2a), and those that are heated by an electric heater inside the iron (shown in Fig. 1-2b). Most radio work is done with an electric iron — the type sent you in Kit 1.

Some servicemen who want a quick-heating fast-cooling iron use a soldering gun (shown in Fig. 1-3) on service calls or for occasional use at the workbench. However,

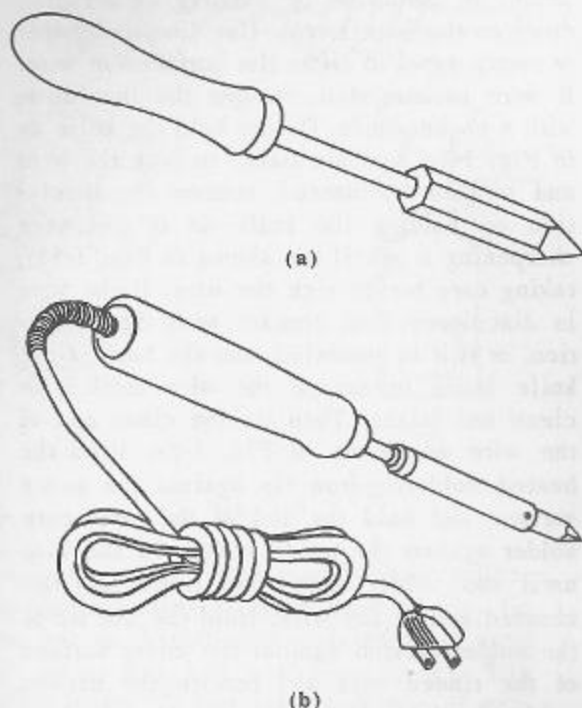


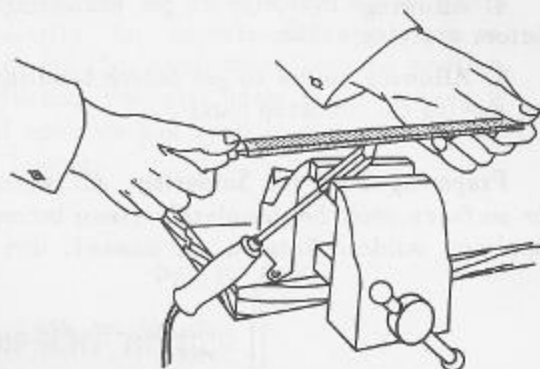
Fig. 1-2

soldering guns are expensive and not suited for continuous duty. If you do a lot of soldering at a time, use a soldering iron.

Tinning the Soldering Iron. The tip of a soldering iron must be coated with solder. This is called *tinning*. Unless the tip is kept clean and well tinned, the copper surface becomes oxidized and pitted. When this happens, the iron does not supply enough



Fig. 1-3



filing soldering iron tip

Fig. 1-4

heat to solder properly. To do good soldering, keep your iron clean and well tinned. When not in use, the iron should be disconnected from the electric outlet, or it will tend to overheat and oxidize. When the tip of your iron is dirty, or has a dull color, wipe it with a clean cloth so that the tip looks shiny. If wiping does not give the tip a shiny look, the tip is oxidized or pitted; file it smooth and then tin the tip before starting to solder.

Tin the iron by carefully following these steps:

1. Let the iron heat up. While it is hot, file one side of the tip (see Fig. 1-4) until the copper looks bright and clean.
2. Immediately apply rosin-core solder to the clean surface until the side of the tip is coated with a thin layer of solder.
3. Repeat the first two steps for each of the other sides of the tip. Use a file to smooth the rough edges.
4. When all sides of the tip are tinned, wipe the excess solder and flux off with a clean rag. Wipe the tip after soldering each joint and it will remain clean longer.

A well-soldered joint depends on:

1. Soldering with a clean, well-tinned tip
2. Cleaning wires or parts to be soldered
3. Making a good mechanical joint before soldering

4. Allowing the joint to get hot enough before applying solder

5. Allowing solder to set before handling or moving the soldered parts

Preparing Work for Soldering. All wires or surfaces must be completely clean before applying solder. Remove all enamel, dirt,

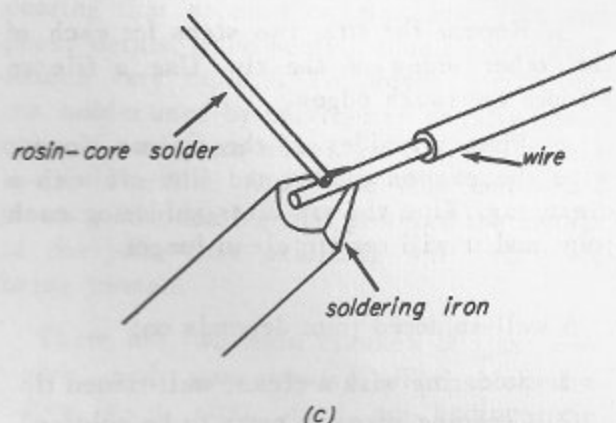
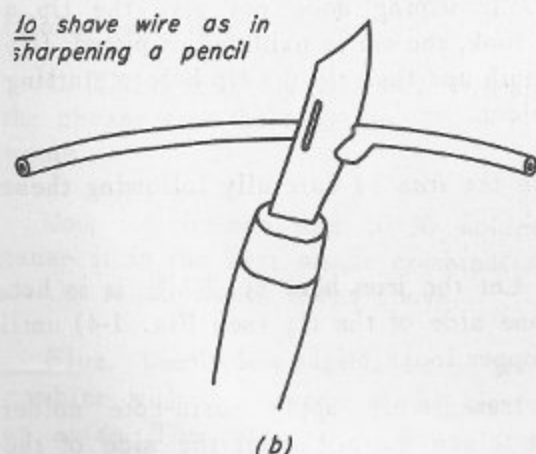
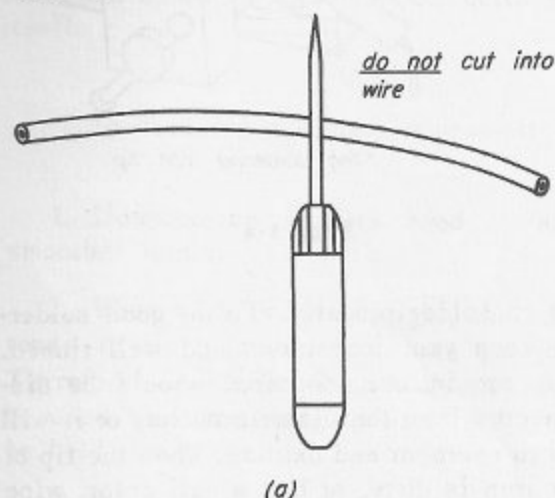


Fig. 1-5

scale, or oxidation by sanding or scraping down to the bare metal. Use fine sandpaper or emery paper to clean flat surfaces or wire. If wire is insulated, remove the insulation with a pocket knife. Do not hold the knife as in Fig. 1-5a; you are liable to nick the wire and weaken it. Instead, remove the insulation by holding the knife as if you were sharpening a pencil (as shown in Fig. 1-5b), taking care not to nick the wire. If the wire is discolored from contact with the insulation, or if it is enameled, use the back of the knife blade to scrape the wire until it is clean and bright. Then tin the clean end of the wire as shown in Fig. 1-5c. Hold the heated soldering-iron tip against the under surface and hold the end of the rosin-core solder against the upper surface of the wire until the solder melts and flows on the cleaned end of the wire. Hold the hot tip of the soldering iron against the under surface of the tinned wire and remove the excess solder by letting it flow down on the tip. When properly tinned, the exposed surface of the wire should be covered with a thin, even coating of solder.

Making a Good Mechanical Joint. Unless you are making a temporary joint, the next step is to make a good mechanical connection between the parts to be soldered. For instance, wrap wire carefully and tightly around a soldering terminal or soldering lug. Bend wire and make connections with long-nose pliers — not with your fingers. Oil or grease from your fingers will cause the solder to run off the joint instead of sticking to the metal. When connecting two wires together, make a tight *splice* (a joining together) before soldering. Figure 1-6 shows how some of these connections look when they are properly made. When a good mechanical contact is made, you are ready for the actual soldering.

Soldering A Joint. The next step is to apply the soldering iron to the joint. In soldering a wire splice, hold the iron below the splice and apply rosin-core solder to the top of the splice, as shown in Fig. 1-7. If the tip of the iron has a little bit of melted solder on the side held against the splice,

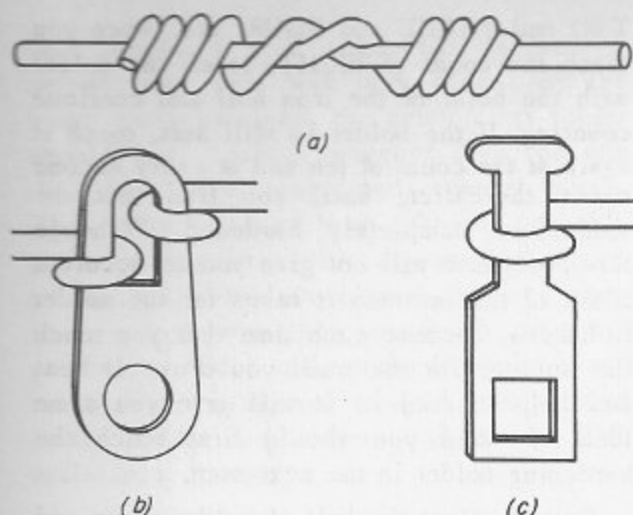


Fig. 1-6

heat is transferred more readily to the splice, and the soldering is done more easily. Be sure not to disturb the soldered joint until the solder has had a chance to set. With 50/50 solder, it may take a couple of seconds or more for the solder to set, depending upon the amount of solder used in making the joint.

METHOD

In the experiments that follow, you will find out how to tell when solder has hardened properly and what happens when it hasn't. You will also be shown the proper methods to use in soldering different kinds of wire. In addition, you will solder radio resistors to terminals mounted on a *breadboard* for use in later lessons. Servicemen call the

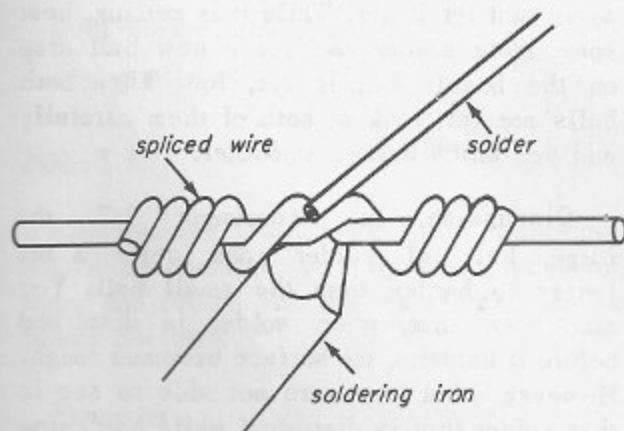


Fig. 1-7

wooden board on which they mount parts temporarily for experimental purposes a *breadboard*. So, when these lessons mention breadboard, you will know that it means a board such as you used in the first part of this lesson.

PART ONE

EQUIPMENT NEEDED

- Soldering iron and stand from Kit 1
- Rosin-core solder from Kit 1
- Piece of cloth for cleaning iron
- Piece of box wood or other board about 4" x 9"
- Nail, two or three inches long

EXPERIMENT 1-1

To melt some solder and watch it change appearance as it hardens.

Procedure.

Step 1. Connect your soldering iron to an electric outlet. Allow it to heat for several minutes.

Step 2. Unroll about five inches of the rosin-core solder.

Step 3. Test the temperature of the iron by touching one side of the tip with the end of the solder, as shown in Fig. 1-8a. The solder should melt freely.

Step 4. Hold the iron over the board with the tip down, as in Fig. 1-8b. Touch the solder to the tip of the iron and let a small ball of solder form and roll off onto the wooden board, as shown in Fig. 1-8b. Immediately, watch the solder as it hardens.

Discussion. As you watched the solder harden in Experiment 1-1, you noticed that the melted solder was, at first, shiny as a mirror. After a few seconds, the entire ball

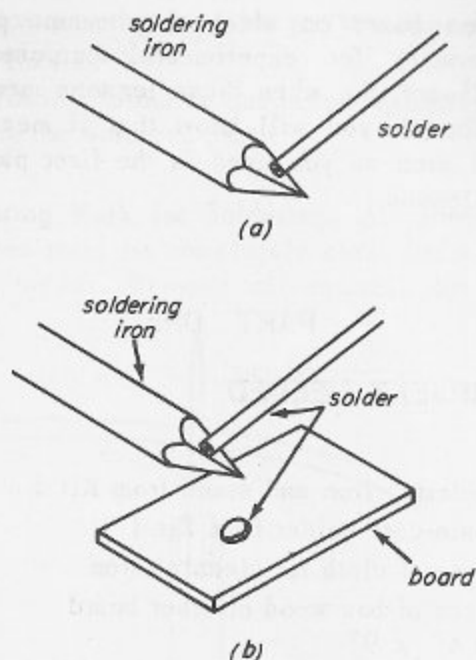


Fig. 1-8

gradually changed to a slightly dull silver, starting from the bottom and working up. The last part to change was at the top. When a soldered joint is cooling, this change in color always takes place. Then the change is rapid, because the metals that are soldered together rapidly draw off the heat from the hardened solder. It is important that you learn to know when a soldered joint is hardened just by looking at it. In this way, you will avoid disturbing solder before it is hardened.

EXPERIMENT 1-2

To discover how long it takes 50/50 melted solder to harden. To learn what happens when solder is disturbed before it hardens and how it appears when it is impure.

Procedure.

Step 1. Heat the ball of solder again until it is melted and then quickly remove the iron. Immediately start counting the seconds it takes for the solder to harden. If you do not have a watch or clock with a second hand, try counting slowly: ONE and

TWO and THREE and FOUR, etc. When you reach the count of EIGHT, touch the solder with the point of the iron nail and continue counting. If the solder is still soft, touch it again at the count of ten and at every second count thereafter, until you find that the solder is completely hardened. Although this procedure will not give you an accurate count of the seconds it takes for the solder to harden, because each time that you touch the solder with the nail, you draw off heat and help to cool it, it will give you some idea of when you should first touch the hardening solder in the next step.

Step 2. Heat the ball of solder again and start counting as before. Touch the solder with the point of the nail when you reach the *highest count* you made in Step 1. The solder may still be a little soft, so, as you continue your count, touch it at every second count until the solder is completely hardened. Repeat this several times until you find that the solder is hardened on your first touch with the nail.

Step 3. Melt some solder with your iron and let it roll off on to the board until you have a ball three or four times as large as the first one. Immediately start counting and, as before, see how long it takes for this larger ball of solder to harden.

Step 4. Heat the larger ball of solder again and touch it with the point of the nail several times as it hardens. Look closely at this solder so that you will know how solder looks when it has been disturbed before hardening.

Step 5. Heat the smaller ball of solder again and let it set. While it is setting, heat some more solder and let a new ball drop on the board. Let it set, too. When both balls are set, look at both of them carefully and see which ball is smoother.

Discussion. In Experiment 1-2, the large ball of solder took quite a bit longer to harden than the small ball. You also saw that when solder is disturbed before it hardens, its surface becomes rough. However, what you were not able to see is that solder that is disturbed while hardening tends to break up, lose a lot of its strength,

and become a poor conductor. In Step 5, unless your iron was very clean and the board was very clean, the new ball of solder should have looked smoother than the one that had been resoldered several times. The solder that had been reheated probably picked up impurities from the wood, the iron, and the air. It was not as good as it was when first melted. For that reason, it does not pay to resolder old solder droppings and reuse them in your soldering. The impurities in the solder may cause weak, noisy, high resistance joints.

PART TWO

EQUIPMENT NEEDED.

Length of tinned solid pushback wire from Kit 1

Length of untinned enameled solid wire from Kit 1

Length of tinned stranded pushback wire from Kit 1

Length of rubber-covered stranded fixture wire from Kit 1

Plain wire solder from Kit 1

Pocket knife

Piece of fine sandpaper

Equipment used in Part One

12 wood screws from Kit 1

12 lugs from Kit 1

Long-nose pliers

Awl or scriber

JOB 1-1

To compare plain solder with rosin-core solder for tinning. To join two pieces of wire, one tinned and the other untinned. To solder the joint.

Procedure.

Step 1. Take the tinned solid pushback wire and pull back the insulation so that

about two inches of wire shows. Hold the wire with your long-nose pliers as you pull the insulation back.

Step 2. With a knife, remove about two inches of insulation from the enameled solid wire. Be careful not to cut or nick the wire.

Step 3. After the insulation is removed, clean the exposed wire with the back of the knife blade or with sandpaper. Clean it until the copper shows brightly.

Step 4. Using the plain wire solder, try to tin the wire you just cleaned. You will find that plain solder, without flux, makes soldering very difficult. Clean the wire again and try tinning it with the rosin-core solder. You should find it much easier to do. Wipe the tinned wire and, if necessary, continue tinning.

Step 5. With the tinned pushback wire and the wire you just tinned, form the splice shown in Fig. 1-9.

Step 6. When the splice is completed, solder the joint. Do not move either wire until the solder sets.

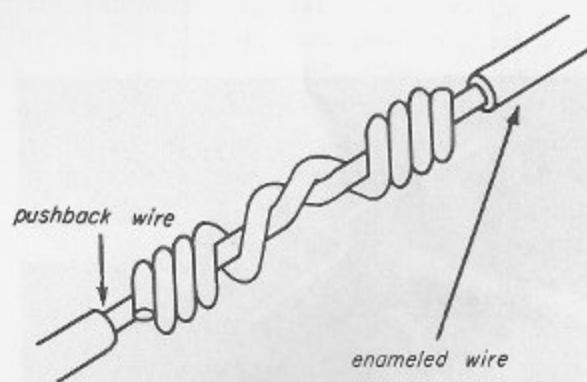


Fig. 1-9

JOB 1-2

To make a splice with two kinds of stranded wire.

Procedure.

Step 1. Expose about one inch of the tinned pushback wire. Twist the strands tightly together and tin the twisted strands.

Step 2. With a knife, remove one inch of insulation from the rubber-covered fixture wire. Fan the strands, as shown in Fig. 1-10a, and clean each strand carefully with sandpaper, until it shines brightly.

Step 3. Tin the strands of the fixture wire and remove the excess solder with the cloth. Twist the strands together and tin them again.

Step 4. With long-nose pliers, form a hook with the exposed end of each of the two wires you have prepared. Had you not tinned both wires, the strands would have loosened as you formed the hooks. Hook them together as shown in Fig. 1-10b. Melt some solder on the tip of the iron and solder the joint. This is a temporary joint used by servicemen while making tests or when connecting parts for a short time only. This joint can easily be unsoldered.

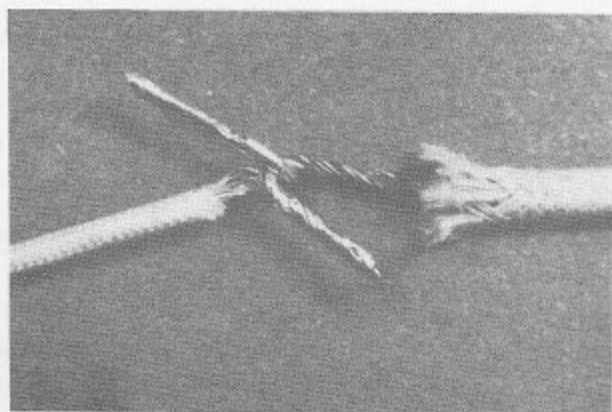
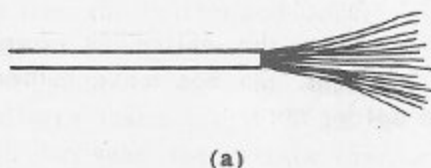


Fig. 1-10

Information. Now let us consider the appearance of the joint after it is soldered. A well-soldered joint starts off as a tight mechanical joint before solder is applied. No more solder is used than is necessary. A large gob of solder, as in Fig.

1-11a, is a sign of poor soldering. When the surface of the solder is rough, as it is in Fig. 1-11b, it usually means that the iron was not hot enough, that the iron was not kept on the joint long enough to heat it properly, or that the joint was disturbed

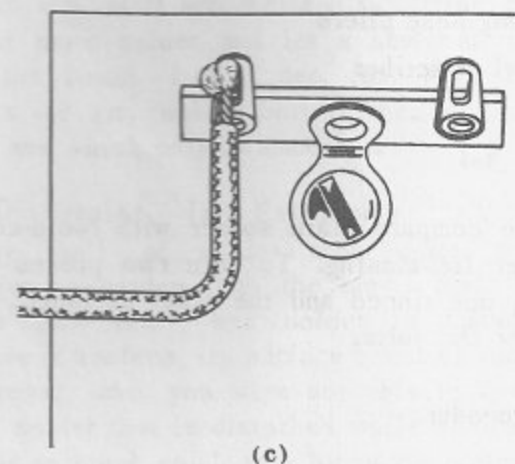
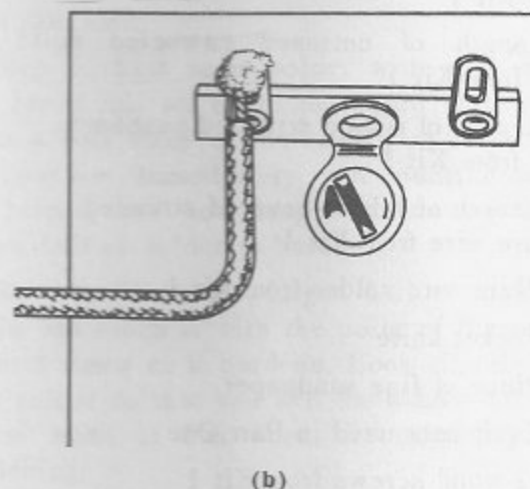
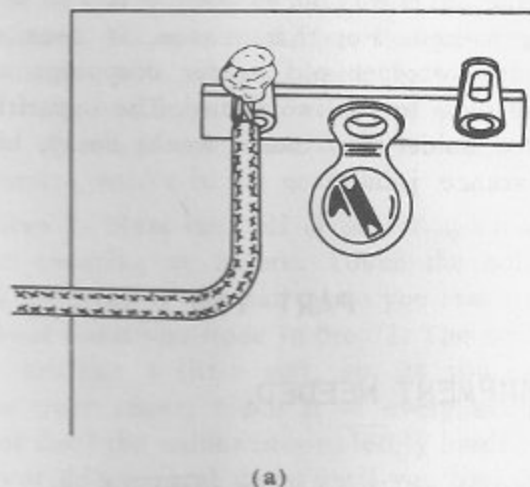


Fig. 1-11

before the solder hardened. Well-soldered joints look like those in Fig. 1-11c. Try to make joints tight and with a smooth, even coating of solder.

The last paragraph says that one reason for poorly soldered joints is that the hot soldering iron is not kept on the joint long enough to heat it properly. However, there are times during the soldering of parts used in radio and TV receivers when, if the iron is kept on the joint too long, the part may change value or may become so badly damaged by overheating that it must be replaced by a new part. For example, during the soldering of carbon composition resistors, overheating may permanently change the value of a resistor. This change in value may be so great that the resistor may cause the circuit to operate incorrectly. Many phono players and radio combinations use a crystal in the phono pick-up arm (the part at the end of the pick-up arm that is connected to a needle that rides in the record grooves). When too much heat is applied to a phono crystal, it may become completely destroyed and need to be replaced by another crystal. Too much heat applied to rotary-switch contacts may cause them to lose springiness and make poor connection with the switch arm or blade.

In such cases, the technician has the problem of heating the connection long enough to have the solder flow properly, and, at the same time, of heating it fast enough so that the part being soldered does not become overheated. From this, you can see that soldering is not simply a matter of keeping the soldering iron on the joint long enough for the solder to flow. Good soldering also requires knowing something about the effects of too much heat on certain parts, so that each step in the making of a joint may be planned before the actual soldering begins. In this way, the soldering may be done efficiently and well in the least amount of time.

JOB 1-3

To mount twelve lugs on a breadboard and to make soldered connections to them.

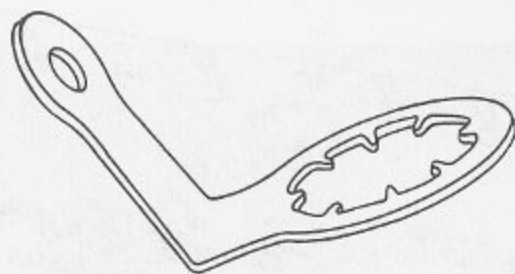


Fig. 1-12

Procedure.

Step 1. Take each of the 12 soldering lugs and, with your long-nose pliers and fingers, bend it about 90 degrees, as shown in Fig. 1-12.

Step 2. The 12 lugs are to be mounted on the 4 x 9-inch breadboard. So, with a pencil, mark off two rows of six dots, as shown in Fig. 1-13.

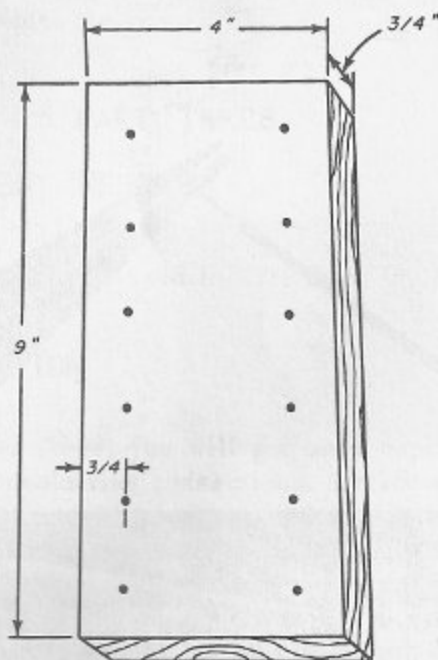


Fig. 1-13

Step 3. With your awl or scribe, make a starting hole about 1/8-inch deep in the center of each dot.

Step 4. Using the small round-head wood screws, mount each of the 12 lugs at the points marked on the breadboard. Face each lug in the direction shown in Fig. 1-14.

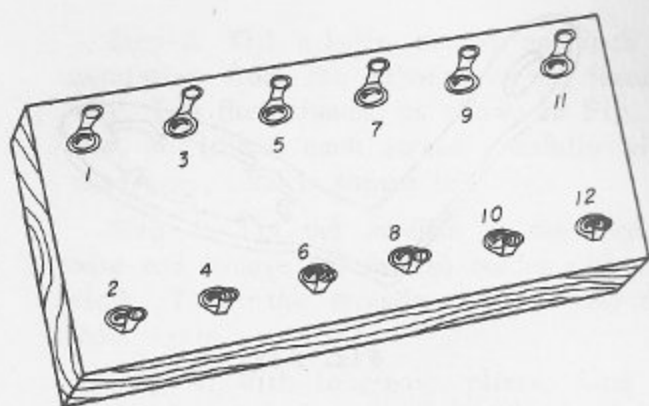
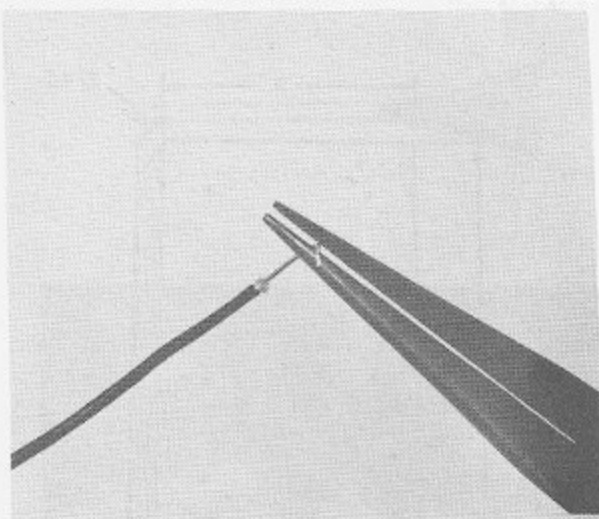


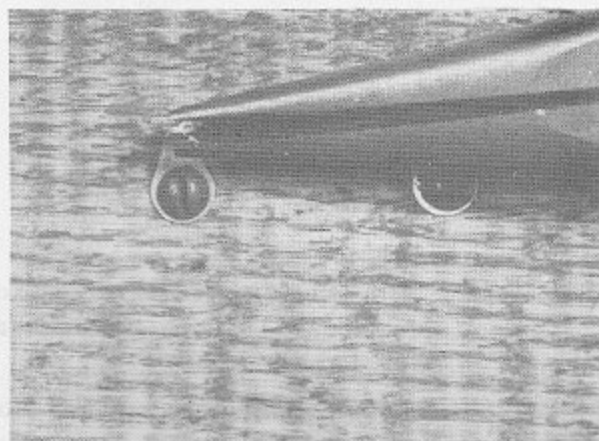
Fig. 1-14

Step 5. Cut away the joints between the two solid wires and between the two stranded wires that you soldered in Jobs 1-1 and 1-2. This will leave about eight inches of each wire.

Step 6. Push back about 1/2-inch of insulation from each end of the solid tinned



(a)



(c)

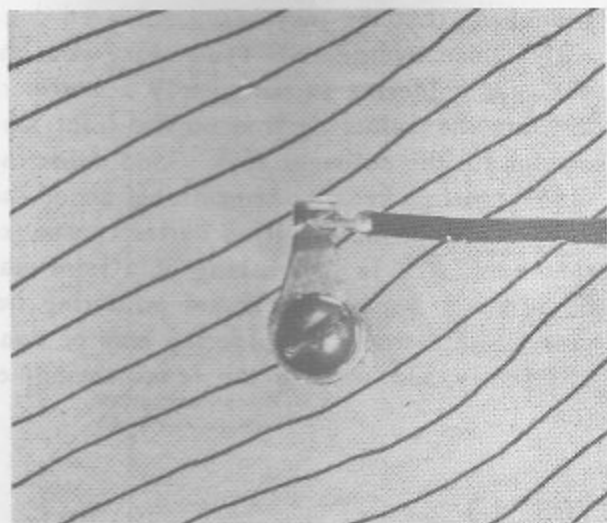
hook-up wire. With your long-nose pliers, bend one end to form a hook, as shown in Fig. 1-15a.

Step 7. Insert the hook in lug #1 and solder it as shown in Fig. 1-15b. This is a temporary joint, because a good mechanical joint was not made before soldering.

Step 8. Form a hook at the other end of the same wire and slip the hook into the second lug. With your long-nose pliers, squeeze the hook together tightly, as shown in Fig. 1-15c. Solder this connection. Be



(b)



(d)

Fig. 1-15

sure not to use too much solder. When you are through, it should look like the joint shown in Fig. 1-15d.

Step 9. Push back about 1/2 inch of insulation from each end of the eight-inch length of stranded hook-up wire.

Step 10. Twist the strands together tightly at each end of this lead and tin each twisted end.

Step 11. With your long-nose pliers, form a hook at each end, as you did with the solid wire. Slip the hook of one end into the third lug and solder the connection. This, too, is a temporary soldered joint because a good mechanical joint was not made before soldering.

Step 12. Slip the hook of the other end into the fourth lug. Squeeze the connection together with your long-nose pliers to make a good tight connection. Solder this connection.

Discussion. Stranded wire should always be twisted tightly and tinned before connecting to a lug or tie terminal. Unless you do this, stranded wire tends to unravel as you bend it and as the hot solder cools after the joint is made. This may produce a cold-soldered joint. In any event, it will produce a poor-looking joint.

In soldering connections like those you have made to the four lugs on the breadboard, always be careful not to touch the insulation with the tip of the hot iron. The heat of iron may burn or melt the insulation. It is a good idea to push insulation back so that it is at least 1/4 inch from the joint to be soldered. After the joint is made and has hardened, the insulation may be pushed back until it meets the joint.

When making temporary connections, and sometimes even when making permanent connections, it is necessary to keep a little tension on the wire. This is done so that the hook is held tightly against the lug while soldering and, particularly, while the soldered joint is cooling. One way to do this is

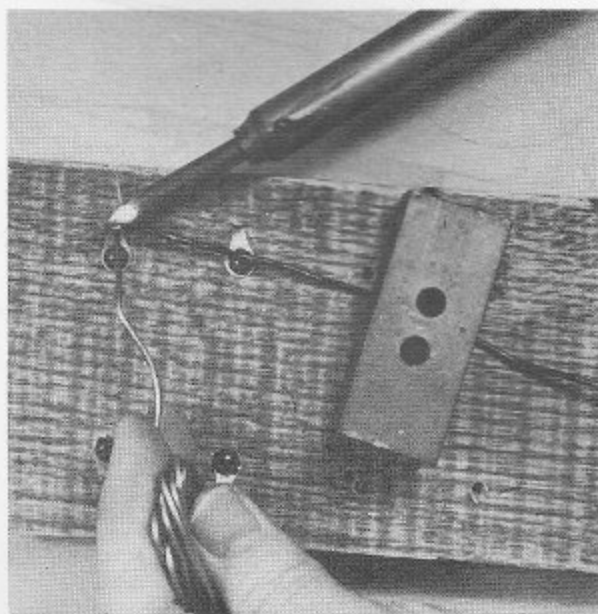


Fig. 1-16

to place a weight on the free end of the wire, as shown in Fig. 1-16, to hold the wire taut as you solder the connection.

PART THREE

EQUIPMENT NEEDED

The equipment used in Part Two

INFORMATION

In Part Three, you will get some experience in unsoldering connections. Servicemen often must unsolder parts to test or replace them. Unless great care is taken while unsoldering, good parts may be broken and have to be replaced needlessly. For example, the lugs on tube sockets, tie terminals, switches, and other parts may break off while a good, tight connection is being unsoldered. Also, the leads of small resistors and capacitors may break off if they are not handled carefully. In addition, unsoldering of resistors and other parts affected by heat must be done carefully and quickly to prevent damaging these parts. Therefore, it is just as important for you to know how to unsolder a connection as to know how to

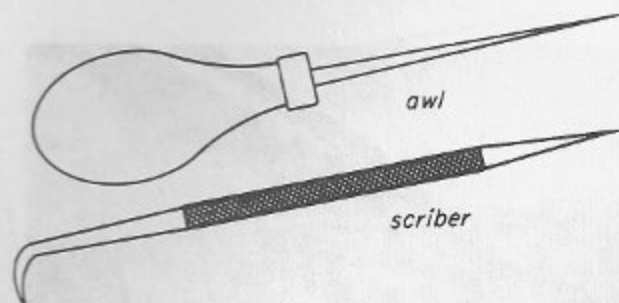


Fig. 1-17

solder a connection. So, in this lesson and in the next lesson, you will get some practice in unsoldering as well as in soldering.

JOB 1-4

To unsolder the four connections made on the breadboard.

Procedure.

Step 1. Put a small bit of solder on one side of your hot soldering-iron tip. (The melted solder on the tip helps to heat the joint more quickly.) Press this side of the tip against the temporary joint on lug #1. Because this is a temporary joint, the wire will unhook easily as soon as the solder melts. Clean the solder from the lug by applying the hot iron until the solder is melted and then by immediately wiping the lug with the cloth.

Step 2. Apply the hot tip against the joint on lug #2. When the solder is melted, insert the scribe or the awl (Fig. 1-17) in the loop of the wire (Fig. 1-18). Carefully open the loop without bending or breaking the lug. When the loop is opened wide enough, slip the wire off the lug. Clean the solder off the lug with the cloth.

Step 3. Using the same method as in Steps 1 and 2, remove the stranded wire from lugs #3 and #4. Clean the lugs.

Discussion. When unsoldering connections and parts in radio and TV equipment, there are several things you must remember:

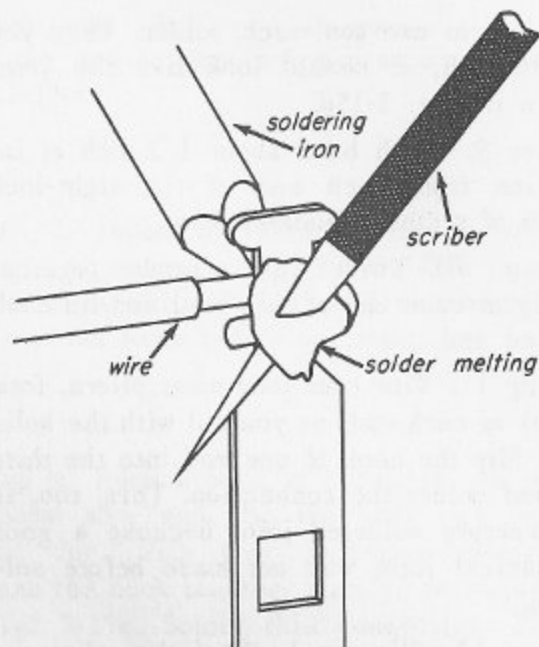


Fig. 1-18

1. Use a "wet" soldering iron tip. In other words, be sure that there is a little melted solder on the face of the tip so that the joint may be heated more quickly.

2. When the solder on the joint is melted, you must work quickly and carefully to loosen the connection. Remember that resistors and some other parts may be damaged by overheating.

3. When loosening a wire lead with an awl, ice-pick, or scribe, be careful not to bend the lug or tie point to which it is attached. Apply pressure evenly between the lug and the wire. Do not try to pull or shake the wire loose from the lug.

4. When unsoldering connections from a tube socket, hold the work in such a position that the solder cannot flow down into the socket.

PART FOUR

EQUIPMENT NEEDED

Six carbon composition 5% resistors from Kit 1 in the following values:

100 ohms
 220 ohms
 330 ohms
 1,000 ohms
 10,000 ohms
 100,000 ohms

Equipment used in Part Two

INFORMATION

In this part of the lesson, you will wire a resistor breadboard that you will use in later experiment lessons. Right now, you will apply some of the knowledge of soldering that you have gained thus far in the lesson. You will mount each resistor between two tie lugs and solder it in place. The resistors are the same kind you would find in any good grade of radio or TV receiver. It is very important that you mount each resistor in the order given in the instructions that follow.

JOB 1-5

To mount six resistors between the twelve lugs on the breadboard.

Procedure.

Step 1. Mount the 100-ohm resistor on the breadboard between the first two lugs, as shown in Fig. 1-19. Be sure to make a good, tight joint. Then solder each resistor lead to its tie terminal.

Step 2. Solder the 220-ohm resistor to the next two terminals.

Step 3. Solder the 330-ohm resistor to the next two terminals.

Step 4. Solder the 1,000-ohm resistor to the next two terminals.

Step 5. Solder the 10,000-ohm resistor to the next two terminals.

Step 6. Solder the 100,000-ohm resistor to the last two terminals.

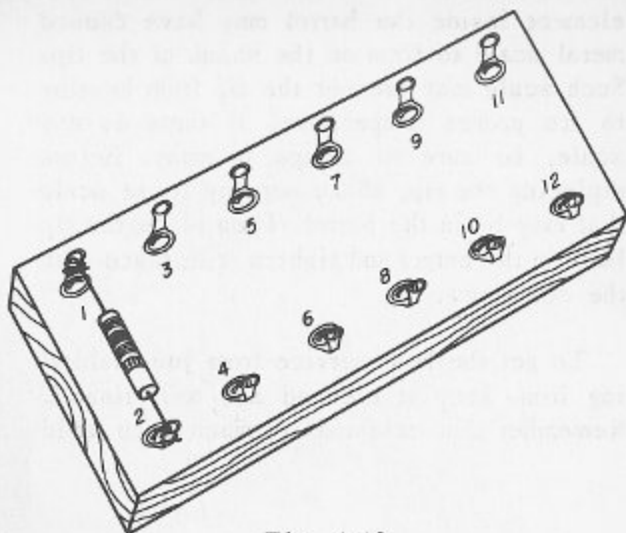


Fig. 1-19

Inspect Your Work. Inspect each of the twelve soldered joints you have made on the resistor breadboard. Be sure that the surface of the solder in each joint is smooth, with just enough solder to make a good joint. This breadboard will be used many times in later lessons, so put it away where you can find it when you want it.

CARE OF YOUR SOLDERING IRON

Examine the tip end of your soldering iron closely. You will see, as shown in Fig. 1-20a, that a set screw holds the copper tip firmly in the barrel of the soldering iron. Loosen this screw about once a week and remove the tip from the barrel, as shown in Fig. 1-20b. Heat from the heating

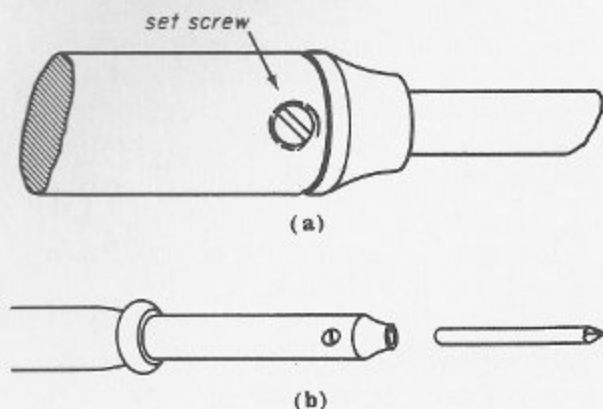


Fig. 1-20

element inside the barrel may have caused metal scale to form on the shank of the tip. Such scale may prevent the tip from heating to its proper temperature. If there is any scale, be sure to scrape it away. Before replacing the tip, shake out any loose scale that may be in the barrel. Then place the tip back in the barrel and tighten it in place with the set screw.

To get the best service from your soldering iron, keep it cleaned and well tinned. Remember that oxidation is much more rapid

when the iron is hot, so do not keep it heated for long periods of time unless you are using it. Do not try to cool it rapidly with ice, snow, or water. If you do, the heating element may be damaged and need to be replaced, or water may get into the barrel and cause rust. Take care of your soldering iron and it will give you many years of useful service.

Replacement tips for your soldering iron may be bought from most radio and electronic parts distributors.

$$\lambda = \frac{186,000}{1,000,000} = .186 \text{ miles}$$

$$\lambda = \frac{300,000,000}{660,000,000}$$

$$f = \frac{300,000,000}{36.6 \text{ ft.}}$$

$$f = \frac{186,000 \times 5280}{36.6 \text{ ft.}}$$

$$36.6 \overline{) 982,278.2} \begin{array}{r} 26832782 \\ 732 \\ 2500 \\ 2196 \\ 3048 \\ 2928 \\ 1200 \\ 1098 \\ 1020 \\ 732 \\ 2880 \\ 2562 \\ 3180 \\ 2928 \\ 2520 \\ 2196 \\ 324 \\ 366 \end{array}$$

$$66 \overline{) 300,000} \begin{array}{r} 4545 \\ 264 \\ 360 \\ 3300 \end{array}$$

$$5280 \overline{) 2080,000} \begin{array}{r} 31680 \\ 42240 \\ 52800 \\ 982080 \end{array}$$

$$1.2601 \overline{) 11,340}$$